

AD-A043 289

GELLMAN RESEARCH ASSOCIATES JENKINTOWN PA  
VERTICAL DISTRIBUTION OF BIOGENIC ELEMENTS IN PORE WATERS OF TH--ETC(U)  
MAR 77 E D ZAITSEVA  
TAMU-REF-77-1-T

F/G 8/10

N00014-75-C-0537

NL

UNCLASSIFIED

| OF |  
AD  
A043 289



END

DATE  
FILMED

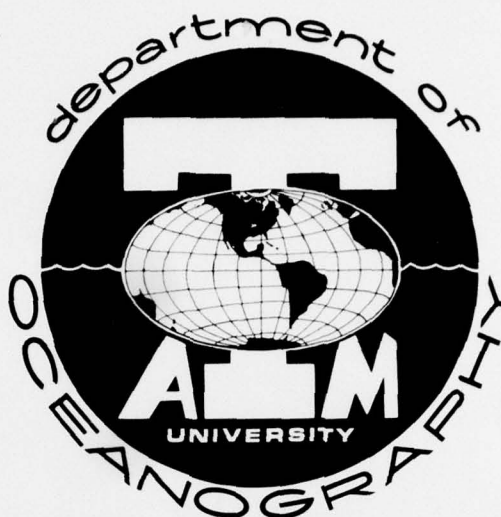
9-77

DDC



AD A 043289

12



VERTICAL DISTRIBUTION OF BIOGENIC ELEMENTS  
IN PORE WATERS OF THE BERING SEA

by

E. D. Zaitseva

TECHNICAL REPORT

(Translation)

by

Leo A. Barnard

DDC  
RECEIVED  
AUG 23 1977  
B

Reference 77-1-T

March 1977

Texas A & M Research Foundation

Office of Naval Research Contract # N00014-75-C-0537

Approved for public release; distribution unlimited.

AD NO.  
DDC FILE COPY

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER 14 TAMU-Res-77-1-T ✓	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) 6 Vertical Distribution of Biogenic Elements in Pore Waters of the Bering Sea		5. TYPE OF REPORT & PERIOD COVERED 9 Technical Report
7. AUTHOR(s) 10 E. D. Zaitseva (Russian) Leo A. Barnard (Translator)		6. PERFORMING ORG. REPORT NUMBER 77-1-T
9. PERFORMING ORGANIZATION NAME AND ADDRESS Department of Oceanography Texas A&M University College Station, Tx. 77843		8. CONTRACT OR GRANT NUMBER(s) ONR N00014-75-C-0537 15
11. CONTROLLING OFFICE NAME AND ADDRESS Office of Naval Research NORDA/NSTL Bay St. Louis, Mississippi 39520		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 16 N 083 036
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) Texas A & M Research Foundation FE Box H College Station, Texas 77840		12. REPORT DATE 11 March 1977
		13. NUMBER OF PAGES 10
		15. SECURITY CLASS. (of this report) Unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report)  Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)  Approved for public release; distribution unlimited.		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number)  pore water, alkalinity, ammonia, phosphate, silicate		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number)  Piston core samples of Bering Sea sediments were squeezed to obtain the interstitial fluids. Horizons sampled and reported are for 0, 2, 4, 8 and 16 m. These fluids were subsequently analyzed for alkalinity, ammonia, phosphate and silicate. Alkalinity and ammonia concentrations in the pore fluids increased uniformly with respect to depth. The ranges of concentration reported are 2.5 - 73.7 mg-equivalents/l for alkalinity and 0.2 - 3.2 mg-equivalents/l for ammonia.		

DD FORM 1 JAN 73 1473A

EDITION OF 1 NOV 65 IS OBSOLETE  
S/N 0102-014-6601

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

401 203

20. Abstract (cont.)

liter

PO<sub>4</sub> mg/liter.

159 mg/l for ammonia-nitrogen. Nitrogen was also determined in the surface horizon and found to vary between 0.04 and 0.29%. In some cases, phosphate also showed an increase in concentration with respect to depth but the range was only 0.2 - 7.5 PO<sub>4</sub> mg/l. Silicate values varied widely and no definable trends were noted. The range of values observed was 11.0 - 30.9 mg-SiO<sub>2</sub>/l. Concentrations of these biogenic elements in the pore fluids are attributed to the regeneration of biogenic material deposited in the sediments. Regeneration occurs in the uppermost layers for the most part and in some cases continues in deeper layers.

ACCESSION for	
NTIS	White Section <input checked="" type="checkbox"/>
DDC	Buff Section <input type="checkbox"/>
UNANNOUNCED	<input type="checkbox"/>
JUSTIFICATION _____	
BY _____	
DISTRIBUTION/AVAILABILITY CODES	
Dist.	/or SPECIAL
A	

TECHNICAL REPORT

Translation of

VERTICAL DISTRIBUTION OF BIOGENIC ELEMENTS  
IN PORE WATERS OF THE BERING SEA

by

E. D. Zaitseva

USSR Academy of Science Reports  
DAN SSSR (1954) Volume 99, Number 2

(Presented to Academician N. M. Strakhov,  
13 September 1954)

Translated by

Leo A. Barnard

Texas A&M University  
Department of Oceanography  
College Station, Texas 77843

Supported by  
Office of Naval Research  
Contract N00014-75-C-0537

77-1-T

March 1977

## Abstract

### VERTICAL DISTRIBUTION OF BIOGENIC ELEMENTS IN PORE WATERS OF THE BERING SEA

Piston core samples of Bering Sea sediments were squeezed to obtain the interstitial fluids. Horizons sampled and reported are for 0, 2, 4, 8 and 16 m. These fluids were subsequently analyzed for alkalinity, ammonia, phosphate and silicate. Alkalinity and ammonia concentrations in the pore fluids increased uniformly with respect to depth. The ranges of concentration reported are 2.5 - 73.7 mg-equivalents/l for alkalinity and 0.2 - 159 mg/l for ammonia-nitrogen. Nitrogen was also determined in the surface horizon and found to vary between 0.04 and 0.29%. In some cases, phosphate also showed an increase in concentration with respect to depth but the range was only 0.2 - 7.5  $\text{PO}_4$  mg/l. Silicate values varied widely and no definable trends were noted. The range of values observed was 11.0 - 30.9 mg- $\text{SiO}_2$ /l. Concentrations of these biogenic elements in the pore fluids are attributed to the regeneration of biogenic material deposited in the sediments. Regeneration occurs in the uppermost layers for the most part and in some cases continues in deeper layers.

Translator  
L. A. B.

The distributions of biogenic elements (P, Si, N and others) in the ( ? pore fluids ? ) of marine sediment cores have come to the attention of geologists and geochemists in connection with investigations of diagenetic processes. There is very little material about this question in the literature.

S. V. Bruevich, R. M. Pevznyak and others <sup>(2)</sup> have studied the question of the vertical distribution of biogenic elements in the ( ? pore waters ? ) in the freshwaters of lake Bicera. Some data concerning this question have been obtained for lake Baikal by K. K. Votintsev <sup>(5)</sup>. S. V. Bruevich and E. G. Vinogradov <sup>(3)</sup> determined the vertical distribution of biogenic elements in the northern, central and southern Caspian (Sea) <sup>(4)</sup>.

The first foreign work to present quantitative data on the distribution of silica in marine pore solutions (in sediments of the near-California region of the Pacific Ocean) and quantitative data on the distribution of ammonia nitrogen, is that of Emery and Rittenberg <sup>(7)</sup>.

Sediment samples in our work were taken with a special geochemical ( ? corer ? ) during an expedition for the Institute of Oceanology AN SSSR and then were taken to the marine laboratory located at the institute. Sediment cores were taken up to 16 meters long. Pore fluids were acquired by squeezing them out in a cast-steel hand-screw press by the method of P. A. Kriukov <sup>(6)</sup>.

The microchemical analytical methods were according to S. V. Bruevich (1).

For convenient comparison of the various changes in the concentrations of biogenic elements in different parts of the sea, all determinations were done for standardized comparison horizons: 1, 2, 4, 8 and 16 meters (See Table 1).

### Results

1. Alkalinity (apparently indicating mineralized carbon from organic matter) and ammoniacal nitrogen in pore solutions showed uniform increases with respect to depth within the sediments, although gradients accumulate differently for different layers of the core. Both of these indicators increase exactly together.
2. The concentration of phosphate-phosphorus in the overwhelming majority of cases in pore fluids of the Bering Sea is shown to systematically increase downward, although substantially less than that shown for ammonical nitrogen.
3. The concentration of silicon vertically did not show any systematic increase downward but varied over a comparatively small range for each station.

4. The increase in alkalinity and biogenic elements at different stations is quantitatively and definitely different--at one station and in some sections of the core, the accumulation (in the pore fluids) was slow and in others, very fast.
5. Comparison of data for stations where the sediments are composed primarily of organic carbon (sta. 553) with stations where there was no organic carbon content in the sediments (most of the stations), clearly shows that most increases in the organic content of the solid phase of the sediments is matched by a like increase in the biogenic elements in the pore fluids.
6. Pore solutions of sediments from shallow stations of average depth (1000 - 4000 meters) characteristically showed significantly large increases in alkalinity and biogenic elements (nitrogen, phosphorus) vertically and large absolute increases in deeper sediments in comparison with upper horizons.
7. Looking at the variations in alkalinity and biogenic elements in the pore fluids of Bering Sea sediments several major things can be noted: the decomposition process for organic matter is not complete in the upper sediment layers, but continues to take place at a decreasing rate for some time in deeper sediments.

Our material illustrates, definitely, that this process is not complete in the upper 16 meters of marine sediments (See Figure 1). Therefore, the decay of organic matter and other related diagenetic processes are continuing in marine sediments hundreds of thousands of years after burial.

The author thanks Prof. S. V. Bruevich for guidance and continuing interest in this work.

Submitted 28 May 1954, Inst. Oceanal., Sci. Inst. of the USSR.

#### Bibliography

1. S. V. Bruevich, Methods for chemical investigation of marine rocks and pore fluids. Moscow, 1944.
2. S. V. Bruevich, R. M. Pevznyak, V. L. Ponizovskaya, M. A. Sibiriyakov, Hydrochemical Materials, 11, publ. AN SSSR, 1935, DAN 21, #6 (1938).
3. S. V. Bruevich, E. G. Vinogradov, DAN, 27, #6 (1940).
4. S. V. Bruevich, E. G. Vinogradov, Hydrochemical Methods, 13, publ. AN SSSR, 1947.
5. K. K. Votintsev, DAN, 75, #1 (1950).
6. P. A. Kriukov, Methods for isolating soil fluids. Recommended methods for the investigation of physico-chemical properties of soils, v. 2, 1947.
7. K. O. Emery, S. C. Rittenberg, Bull. Am. Assoc. of Petroleum Geol., 36, #5 (1952).

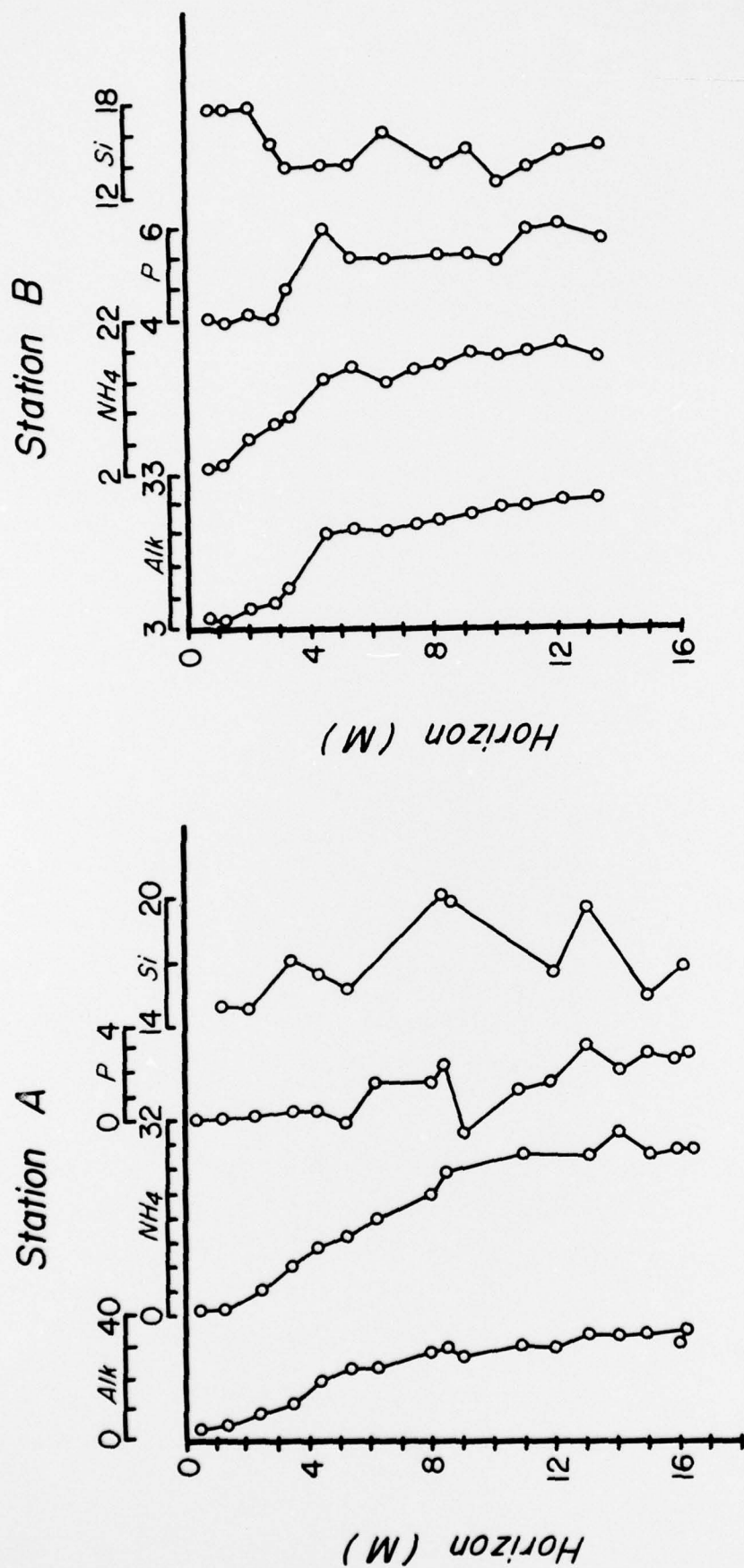


Figure 1. Vertical distribution of alkalinity and biogenic elements in pore fluids of cores from the Bering Sea. A - Sta. 540, B - Sta. 619. All concentrations are reported in milligrams/liter except for alkalinity which is in units of milligram-equivalents/liter.

Table 1. Measurements of the composition of pore fluids with depth in the sediments of the Bering Sea in 1950. (Sediment horizons are in meters from top to bottom.)

Sta. #	Nitrogen content of the upper horizon (m %)	Horizon										ammonia-nitrogen, mg/l		
		alkalinity												
		0	1	2	4	8	16	0	1	2	4		8	16
		(water) depth 0 - 150 m												
568	0,038	2,75	12,8	--	--	--	--	3,6	--	--	--	--	--	
565	0,037	10,9	26,9	--	--	--	--	11,4	25,4	--	--	--	--	
557	0,14	2,5	8,6	17,5	--	--	--	1,2	7,6	17,0	--	--	--	
553	0,29	41,7	66,2	72,7	(73,7)	--	--	45,0	111,0	159,0	(145,0)	--	--	
612	0,17	2,9	3,0	6,3	(21,9)	--	--	(water) depth 1000 m					--	--
617	--	(2,6)	4,2	6,0	8,6	--	--	(water) depth 2000 m					--	--
614	--	3,0	5,2	6,5	(11,0)	--	--	(water) depth 3000 m					--	--
540	0,092	(3,5)	3,8	5,7	13,5	29,2	38,5	0,68	2,9	3,8	(11,6)	--	--	
619	0,084	(3,8)	3,8	5,9	16,8	24,4	(32,0)	1,7	1,8	3,6	10,5	21,5	31,8	
615	--	(6,6)	7,5	8,8	9,4	12,2	--	(2,8)	3,2	5,9	12,4	16,5	(18,6)	
537	0,086	2,6	5,6	8,2	(15,9)	--	--	(4,3)	4,5	4,9	5,4	(6,4)	--	
618	0,088	2,6	3,3	4,3	6,5	--	--	0,24	5,3	6,0	(15,0)	--	--	
533	--	(1,73)	10,52	--	--	--	--	0,61	1,9	3,0	5,0	--	--	
								(1,6)	4,1	--	--	--	--	

Table 1 (cont.)

Sta. #	Nitrogen content of the upper horizon (m %)	Horizon											
		phosphate-phosphorus, mg / ℓ											
		0	1	2	4	8	16	0	1	2	4	8	16
		silica, mg / ℓ											
		(water) depth 0 - 150 m											
568	0, 038	1, 6	4, 0	--	--	--	--	14, 5	12, 2	--	--	--	--
565	0, 037	6, 3	3, 2	--	--	--	--	11, 0	--	--	--	--	--
557	0, 14	0, 35	1, 8	1, 7	--	--	--	13, 7	--	--	--	--	--
553	0, 29	2, 5	4, 5	4, 7	(7, 5)	--	--	26, 8	14, 0	16, 0	23, 2	--	--
		(water) depth 1000 m											
612	0, 17	0, 25	0, 26	0, 67	--	--	--	12, 7	16, 2	17, 2	--	--	--
		(water) depth 2000 m											
617	--	0, 20	(0, 21)	0, 40	0, 77	--	--	(17, 7)	16, 5	12, 6	13, 0	--	--
		(water) depth 3000 m											
614	--	0, 25	0, 38	0, 43	(1, 2)	--	--	15, 5	17, 0	16, 2	(15, 2)	--	--
540	0, 092	(0, 17)	0, 17	0, 25	0, 70	1, 9	3, 0	--	14, 7	14, 7	17, 5	20, 7	17, 5
619	0, 084	(0, 43)	0, 39	0, 46	4, 4	4, 4	5, 4	(17, 7)	17, 7	17, 7	13, 8	14, 4	15, 7
615	--	(0, 27)	0, 50	0, 79	0, 69	0, 35	--	(14, 0)	14, 0	14, 1	14, 6	16, 8	--
537	0, 086	0, 17	0, 57	0, 68	(1, 6)	--	--	15, 5	26, 8	30, 9	29, 8	--	--
618	0, 088	0, 22	0, 26	0, 31	0, 95	--	--	13, 5	18, 0	12, 4	12, 7	--	--
533	--	(0, 65)	1, 3	--	--	--	--	(19, 0)	14, 2	--	--	--	--

Note: 1. Numbers in parenthesis denote samples taken not exactly at the standard horizon. The sample at Station 553 is from below an area of high biological productivity. 2. Phosphate-phosphorus and silica were analyzed by A. V. Fotiev.

Translators Notes:

1. The phrase "gruntoviy rastvor" has been translated throughout as "pore fluids" and is equivalent to the more modern phrase "ilovaya voda." It is also of interest that these two phrases are commonly mistranslated as "wet sediments", "silty-water", "dirty-water", "silt" or "sediments". The distinction is quite important.
2. The word "trubka" is translated as "corer" based on context and other authors' use.
3. The words "monalit" and "kolonka" are translated as "core" based on context.

L. A. B.

Acknowledgements:

This work was supported by the Office of Naval Research  
Contract N00014-75-C-0537.

MANDATORY DISTRIBUTION LIST

FOR UNCLASSIFIED TECHNICAL REPORTS, REPRINTS, & FINAL REPORTS  
PUBLISHED BY OCEANOGRAPHIC CONTRACTORS  
OF THE OCEAN SCIENCE AND TECHNOLOGY DIVISION  
OF THE OFFICE OF NAVAL RESEARCH

(REVISED JAN. 1975)

1	Director of Defense Research and Engineering Office of the Secretary of Defense Washington, D. C. 20301 ATTN: Office, Assistant Director (Research)	12	Defense Documentation Center Cameron Station Alexandria, Virginia 22314
	Office of Naval Research Bay St. Louis, Miss. 39520		Commander Naval Oceanographic Office Washington, D. C. 20390
3	ATTN: (Code 481)	1	ATTN: Code 1640
1	ATTN: (Code 460)	1	ATTN: Code 70
1	ATTN: (Code 102-OS)		
6	ATTN: (Code 102-IP)	1	NODC/NOAA Department of Commerce Rockville, Md. 20882
1	Mr. Frank Lucas Office of Naval Research Resident Representative Federal Building, Rm. 582 300 East 8th Street Austin, Texas 78701		
	Director Naval Research Laboratory Washington, D. C. 20375		
6	ATTN: Library, Code 2620		